

REMARKS/ARGUMENTS

Claims 15-25 are pending in the present application. Claims 15-25 have been rejected. Claims 21 and 25 have been cancelled by the present amendment. Claim 15 has been amended. Claim 26 has been added. No new matter has been introduced.

Claims 15 and 17-24 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 5,746,051 to Kieser et al. (hereinafter Kieser) in light of U.S. Patent 6,565,716 to Ruan et al. (hereinafter Ruan). Claim 16 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Kieser in light of Ruan and further in view of U.S. Patent 5,407,639 to Watanabe et al. (hereinafter Watanabe) and/or U.S. Patent 5,746,984 to Hoard (hereinafter Hoard). Reconsideration is respectfully requested of these rejections based upon the following considerations.

Distinctions Over Kieser in view of Ruan

To establish a *prima facie* case of obviousness, there must be some suggestion or motivation to modify the reference to arrive at the Applicant's invention, there must be a reasonable expectation of success, and the prior art reference or combination of references must teach or suggest all of the claim limitations.

Applicants' submit that there is nothing in Kieser or Ruan that teaches or suggests modifying the references to arrive at the present method for preparing a non-thermal plasma reactor comprising forming cell building blocks of material having a high dielectric constant, the cell building blocks having cell walls forming an exhaust passage for flowing gas to be treated therethrough; printing a conductive print onto an outer surface of at least one of the cell walls; assembling the cell building blocks into a multi-cell stack; preparing electrical connections for connecting the multi-cell stack to a high

voltage source; applying insulation to the multi-cell stack; and inserting the multi-cell stack into a non-thermal plasma reactor housing.

Features and advantages of the present cell building block method, include, but are not limited to, providing a method that eliminates the need for supplying discrete insulating spacers or other plate holding devices to create exhaust passages as required with methods employing series of stacked, parallel plates. By employing cell building blocks (for example, full cell building blocks or pairs of half cell building blocks), instead of a plurality of plates with spacers, spacers are not required to create exhaust passages between the flat plates, providing, for example, a much simplified assembly process. The cell building blocks are formed and printed with conductive electrode on an outside region of the building block cell wall thereby forming true building blocks from which a multi-cell stack of a desired size can be created from the underlying building block structures. The building blocks are reading for stacking with correct orientation, insulating plates 44, 46 being provided at the top and bottom of the multi-cell stack of building blocks to protect the conductive prints. Each building block conductive print is connected to a power source (for example, high voltage AC source) using any suitable method (for example, brazed connections). The multi-cell stack is held together using any suitable method, for example, the stack may be held in place using dielectric insulation which is compressed inside the exhaust housing.

Kieser describes in the Abstract thereof, in automobiles, for example, the exhaust fumes must pass through a plasma reactor operating by the principle of dielectrically inhibited ("silent") discharge, consisting of an arrangement of flat plates with alternating metallic and dielectric layers, whereby a plurality of adjacent discharge paths in parallel in the flow direction are formed. According to the invention of Kieser, the discharge paths border on a single metallic electrode surface or layer (62, 72) and the electric power is supplied (58, 59) from two different sides with the metallic layers (62, 72)

having alternate polarities. Kieser describes parallel plate reactors employing spacers to create exhaust passages between adjacent parallel plates. See Abstract of Kieser.

Kieser shows in FIGS. 1 and 2 that spacers 66 are arranged between each insulating plate 64 and the adjacent electrode 62. These spacers keep electrodes 62 and insulating plates 64 apart at a distance s , which defines the flashover distance of the silent discharge. See Kieser, Column 2, lines 1-5. Kieser shows in FIG. 3 an arbitrary number of flat rectangular ceramic plates 74 are arranged parallel to one another and to two of the insulating plates 61 forming the discharge vessel. Each of ceramic plates 74 is plated on one side with a permanently adherent metal layer 72 of uniform thickness, serving as an electrode. Also in this case, spacers 66 are arranged between two ceramic plates 74 and determine the flashover distance s of the silent discharge. In this case this is the distance between a metallic layer 72 and the adjacent ceramic plate 74. See Kieser, Column 3, lines 26-37.

Kieser does not teach or suggest the present method comprising forming cell building blocks of material having a high dielectric constant, the cell building blocks having cell walls forming an exhaust passage for flowing gas to be treated therethrough; printing a conductive print onto an outer surface of at least one of the cell walls; assembling the cell building blocks into a multi-cell stack; preparing electrical connections for connecting the multi-cell stack to a high voltage source; applying insulation to the multi-cell stack; and inserting the multi-cell stack into a non-thermal plasma reactor housing.

Ruan describes in the Abstract thereof, a dielectric barrier discharge system includes first and second non-thermal plasma reactors which are coupled together in series. The first reactor includes a first surface discharge electrode which defines a first discharge path along the first surface discharge electrode. The second reactor includes second and third electrodes which are separated by a gap and define a second discharge

path which extends across the gap. The system can be used to decompose hazardous compounds in a liquid or a gas, such as in power plant flue gases. See Abstract of Ruan.

In the system 10 of Ruan, a pretreatment NTP reactor 16 is a "surface discharge" type of reactor which has one or more electrodes that produce surface plasma along the surfaces of the electrodes. In contrast, main NTP reactor 18 is a "silent" type of reactor which has two or more parallel electrodes that produces various plasma species across a gap between the electrodes. See Ruan at Column 3, lines 26-34.

In FIG. 8 of Ruan, a main NTP reactor 18 includes a housing 220, a plurality of parallel, planar electrodes panels 222A-222E, and high voltage power source 224. See Ruan at Column 6, lines 56 to 60. Electrode panels 222A-222E extend vertically within housing 220 and are arranged to define a winding flow path in the direction of arrows 230, from fluid inlet 28 to fluid outlet 20. Electrodes 222A-222E each include a conductor 240 such as a thin conductive plate or wire mesh which is embedded between two opposing layers of dielectric material 242 and 244. See Kieser at Column 6 lines 63-67 and at Column 7, lines 1-2. The separation between adjacent electrodes 22A-222E defines individual reaction volumes, or discharge volumes, 252A-252D which are connected together in series. See Ruan at Column 7, lines 10-12. FIGS. 9 and 10 of Ruan show alternate embodiments of parallel plate reactors for the main NTP reactor of the system.

Ruan does not teach or suggest the present method comprising forming cell building blocks of material having a high dielectric constant, the cell building blocks having cell walls forming an exhaust passage for flowing gas to be treated therethrough; printing a conductive print onto an outer surface of at least one of the cell walls; assembling the cell building blocks into a multi-cell stack; preparing electrical connections for connecting the multi-cell stack to a high voltage source; applying

insulation to the multi-cell stack; and inserting the multi-cell stack into a non-thermal plasma reactor housing.

Further, in making a determination of obviousness, the claimed invention as a whole must be considered. Neither Kieser nor Ruan teach or suggest the present method including preparing a non-thermal plasma reactor from cell building blocks. Even if one were to combine the parallel plate reactor of Kieser with the dual NTP reactor system of Ruan comprising a surface discharge reactor and a parallel plate dual reactor, one would not arrive at the present method for at least the reason that neither Keiser nor Ruan disclose the present claim elements of forming cell building blocks of material having a high dielectric constant, the cell building blocks having cell walls forming an exhaust passage for flowing gas to be treated therethrough; printing a conductive print onto an outer surface of at least one of the cell walls; and assembling the cell building blocks into a non-thermal plasma reactor multi-cell stack.

With respect to Claims 20, and 22-24, neither Kieser nor Ruan reach or suggest the present building block method. Kieser does not teach or suggest disposing a catalytic coating on a cell building block as presently disclosed and claimed. An additional advantage to the embodiment of the present method as shown for example in FIG. 6 is the resultant "open" face provided on each building block piece, allowing for a catalytic coating to be printed on one or both faces, if desired. In contrast, Kieser is again referring at Column 4, lines 1-6 (FIG. 5 of Kieser) to a parallel plate reactor. In this embodiment of Kieser's parallel plate reactor, an insulating material 84 serves as the parallel plates instead of the parallel plates 64 of FIG. 1. See Kieser at Column 3, lines 60-67 and at Column 4, lines 1-2. Similarly, neither Kieser nor Ruan are connecting cell building blocks to provide a multi-cell stack of building blocks forming a non-thermal plasma reactor.

Distinctions Over Kieser in view of Ruan and Further in View of Watanabe

Claim 16 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Kieser in view of Ruan and further in view of Watanabe and/or Hoard.

Watanabe describes in the Abstract thereof a method of manufacturing a corona discharge device suitable for use as an ozonizer capable of producing a controlled small amount of ozone throughout a prolonged service life. A foreproduct of corona discharge device (50) is first prepared which is provided with first and second planar electrodes (54; 56) capacitively coupled with each other by a third floating electrode (64) which is coated by a protective layer (68) of chemically resistive electrically insulating material. A high frequency alternating voltage having a voltage level higher than an initial minimum flashover voltage level of the foreproduct is then applied until the protective layer is aged. Aging of the protective layer is effective in lowering the initial minimum flashover voltage of the final product thus obtained as well as in reducing any fluctuation of the initial minimum flashover voltage that would otherwise occur from product to product. See Abstract of Watanabe.

Watanabe describes a method of making the corona discharge device 40 with reference to FIGS. 8A and 8B. A slurry of ceramic-forming dielectric material, such as alumina ceramic-forming material, is first prepared and is formed into a green sheet by any conventional process such as doctor blade process. After drying, electrode patterns 88 are printed on the upper and reverse surfaces of the green sheet. A paste of ceramic-forming dielectric material is printed by conventional screen printing technique to form the dielectric layer 66. After drying, an electrode pattern 94 of the paste of conductive material is printed over the dielectric layer to provide the outer floating electrode 64 and the product is again subjected to drying. Thereafter, a paste of chemically-resistive electrically-insulating material is screen printed to form the protective layer 68. After drying, the product is subjected to sintering in a reducing atmosphere to obtain a

foreproduct 96 of the corona discharge device. The thus prepared foreproduct of corona discharge device is then aged to obtain a final product by applying a high frequency alternating voltage between the inner electrodes 54 and 56. See Watanabe at Column 8, lines 17-68.

A *prima facie* case of obviousness must be established from analogous art. A person of ordinary skill in a particular art of interest will not likely know about prior art in a different and unrelated field of technology. Such art, therefore, would not render an invention obvious. Applicants submit that an obviousness rejection based upon Watanabe is improper as Watanabe is a non-analogous art references or is too far removed from Applicants' field of endeavor and so is incapable of supporting an obviousness rejection under 35 U.S.C. § 103. Watanabe teaches a method for forming a corona discharge device for use as an ozonizer. A person having ordinary skill in the art would not reasonably have expected to solve the problems relating to preparing non-thermal plasma reactors for treating auto emissions by considering a reference dealing with methods for preparing a corona discharge device which may suitably be used as an ozonizer for deodorization of ambient air bearing malodorous substances. See Watanabe at Column 1, lines 7-11. Applicants submit that it is overly broad and all encompassing to regard the cited references as analogous art to the Applicants' field of endeavor relating to reactors suitable for use in conditions found in a mobile emitter such as a car or truck.

Further, even if one were to apply Watanabe and/or Hoard, there is nothing in Watanabe or in Hoard that teaches or suggests the present method for forming a non-thermal plasma reactor of building blocks which are stacked together to form a multi-cell stack.

Hoard describes in the Abstract thereof an exhaust system for a combustion system, comprising a storage device for collecting NO_x, hydrocarbon, or particulate

emissions, or mixture of these emissions, and a plasma reactor for destroying the collected emissions. After the emission is collected in by the storage device for a period of time, the emission is then destroyed in a non-thermal plasma generated by the plasma reactor. See the Abstract of Hoard. With respect to the storage device, in one preferred embodiment, the adsorbing material is coated onto the surface of a honeycomb monolith in the storage device. The honeycomb monolith is preferably a ceramic honeycomb monolith of the type widely used for automotive catalytic converters. These monoliths are well known in the art. Such monoliths are extruded from synthetic cordierite materials (ideally $\text{Mg}_2\text{Al}_4\text{Si}_5\text{O}_{18}$) according to well known ceramic processes. The one piece honeycomb monolith may be coated with a NO_x or hydrocarbon adsorbing material. Hoard at Column 7, lines 59-67, at Column 8, lines 1-23. Hoard does not teach or suggest forming cell building blocks comprising full cell or half cell building blocks via extruding.


Application No. 09/808,245
Amendment dated November 5, 2004
Reply to Office Action of August 6, 2004
Attorney Docket No. DP-300505div

Based upon the remarks presented herein, it is submitted that the Examiner's outstanding rejections have been overcome. As a result, Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Should the Examiner have any questions regarding this matter, the Examiner is requested to contact Mr. Paul L. Marshall, who may be reached in the Troy, Michigan area at (248) 813-1214.

If there are any additional charges with respect to this Response or otherwise, please charge them to Deposit Account No. 50-0831 maintained by Applicants' attorney.

Respectfully submitted,
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